MECH 2311 Introduction to Thermal-Fluid Science

Course Information

Term:	Spring 2026
CRN:	27123
Delivery Method:	In Person
Meeting Day and Time:	4.30 – 5.50 PM, M.W.
Location:	Classroom Building, C305

Instructor

Sumit Chanda
Assistant Instructor,
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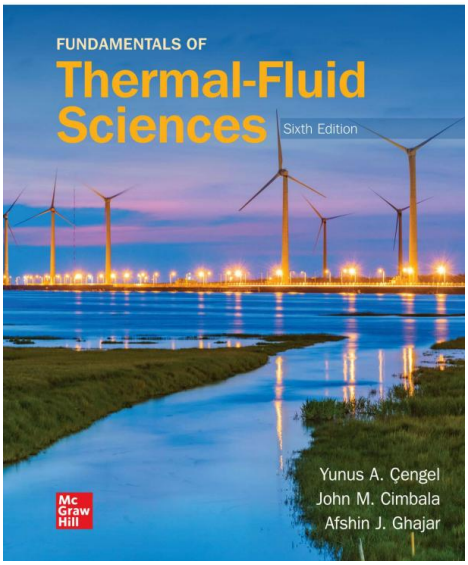
E-mail address: schanda@miners.utep.edu
Office hours: TR 4-4.50pm on MS Teams
(By appointment only)
Communication preference: MS Teams



Textbook

Fundamentals of Thermal-Fluid Sciences
by Yunus Cengel, John Cimbala, and Robert Turner
McGraw Hill

Course Description

An introduction to basic concepts of thermodynamics and fluid mechanics to include properties, property relationships, states, and fluids. Presentation of the basic equations of thermal-fluid science, continuity, first and second laws of thermodynamics, and fluid flow in various conditions.

Prerequisites are MATH 1312 Calculus II with a grade of "C" or better.

Course Content

1. Introduction the Thermodynamics and Fluid Mechanics (Chapter 1)

2. Basic Concepts of Thermodynamics (Chapter 2)
   - Systems and Control Volumes
   - Properties of a System
   - Density and Specific Gravity
   - State and Equilibrium
   - Zeroth Law of Thermodynamics
   - Pressure
   - The Manometer

3. Energy, Energy Transfer, and General Energy Analysis (Chapter 3)
   - Forms of Energy

- Energy Transfer by Heat
- Energy Transfer by Work
- Mechanical Forms of Work
- First Law of Thermodynamics
- Energy Conversion Efficiencies

4. Properties of Pure Substances (Chapter 4)
   - Phases of a Pure Substance
   - Phase-Change Processes of Pure Substances
   - Property Diagrams for Phase-Change Processes
   - Property Tables
   - The Ideal-Gas Equation

5. Energy Analysis of Closed Systems (Chapter 5)
   - Moving Boundary Work
   - Energy Balance for Closed Systems
   - Specific Heats
   - Internal Energy, Enthalpy, and Specific Heats of Ideal Gases
   - Internal Energy, Enthalpy, and Specific Heats of Liquids

6. Mass and Energy Analysis of Control Volumes (Chapter 6)
   - Conservation of Mass
   - Flow Work and the Energy of a Flowing Fluid
   - Energy Analysis of Steady-Flow Systems

7. The Second Law of Thermodynamics (Chapter 7)
   - Introduction to Second Law
   - Thermal Energy Reservoirs
   - Heat Engines
   - Refrigerators and Pumps
   - Reversible and Irreversible Processes
   - The Carnot Cycle
   - The Carnot Principles
   - Thermodynamic Temperature Scale
   - Carnot Heat Engine
   - The Carnot Refrigerator and Pump

8. Introduction to Properties of Fluids (Chapter 10)
   - The No-Slip Condition
   - Classification of Fluid Flows
   - Viscosity

9. Introduction to Basics of CFD
   - Introduction to CFD methodology
   - Workflows for CFD tools (ANSYS/StarCCM+)

10. Fluid Statics (Chapter 11)

- Introduction to Fluid Statics
- Hydrostatic Forces on Submerged Plane Surfaces

11. Bernoulli and Energy Equations (Chapter 12)
    - The Bernoulli Equation
    - General Energy Equation
    - Energy Analysis of Steady Flows

12. Momentum Analysis of Flow Systems (Chapter 13)
    - Newton's Laws
    - Choosing a Control Volume
    - Forces Acting on a Control Volume
    - The Linear Momentum Equation

Course Objectives

Upon completion of this course, students should be able to:

- ✓ Understand concepts of temperature, pressure, and energy
- ✓ Evaluate properties of pure substances and use property data for solving problems
- ✓ Apply the principles of conservation of mass and energy to closed and open systems
- ✓ Understand and apply the second law of thermodynamics, including concepts such as irreversibility and Carnot cycle
- ✓ Understand the basic concepts of fluid mechanics and properties such as viscosity and surface tension
- ✓ Solve fluid statics problems
- ✓ Apply the Bernoulli and energy equations
- ✓ Apply the conservation of linear momentum to control volumes

Blackboard

The instructor will use Blackboard for uploading lecture slides, updating the syllabus (if necessary), and communicating with students.

Class Delivery

The class will be delivered in in-person mode or as informed by instructor.

Final Project

The final project will involve solving a relevant thermo-fluid problem and validating hand calculations using a CFD tool such as ANSYS or STAR-CCM+. The project will be completed in team groups and will also be evaluated on a presentation component. Additional details will be provided before the project topic is assigned.

Midterm Exam

Midterm exams will be taken in person during the class and will be typically 1 hour long. Students are required to bring necessary accessories, including the calculator. No makeup exams will be taken unless prior excuse/permission.

- Students are NOT allowed to go to restrooms during the test. Students with disabilities must have a letter of accommodation and coordinate this with the instructor.
- Students are NOT allowed access to any materials in their backpacks without permission.
- Students can NOT use devices during the exam (such as cell phones, iPads, iPods, and wristwatches).
- Late students are NOT allowed to take the exam 15 minutes after starting the test.
- No wearing hats is allowed during the test.

Quizzes and Assignments

There will be a quiz after the completion of every two chapters (or at the discretion of the instructor). Each quiz will be held during the first 15 minutes of class.

There will be several assignments/homework at regular intervals during the semester. You are required to submit the assigned work on or before the deadline. **Late submission of the assigned work will not be allowed unless medical and emergency reasons exist (**Student needs to email the instructor prior to the deadline to be eligible for such exemptions).

Grading

The following percentages of the assignments, exams, and projects will constitute the basis for the assigning of the final grade in the course:

Class performance & Quizzes: 10%

Homework: 15%,

Attendance: 10%,

Midterm 1: 15%, (Module 1-4)

Midterm 2: 15%, (Module 5-8)

Midterm 3: 15%, (Module 9-11)

Final project: 20%

Final Grade Scheme

A: 90-100%
B: 80-89%
C: 65-79%
D: 50-64%
F: ≤ 49%

Technology Requirements

Some course content is delivered via the Internet through the Blackboard learning management system. Ensure your UTEP email account is working and you have access to the Web and a stable web browser. Google Chrome and Mozilla Firefox are the best browsers for Blackboard; other browsers may cause complications. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

Students will need to have access to a computer/laptop. Students will need to download or update the following software: Microsoft Office, Adobe Acrobat Reader, Windows Media Player, QuickTime, and Java. Check that your computer hardware and software are up-to-date and able to access all parts of the course.

If the students do not have word-processing software, they can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook, and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about Microsoft Office 365 and follow the instructions.

IMPORTANT: If any student encounters technical difficulties beyond their scope of troubleshooting, please contact the UTEP Help Desk, as they are trained specifically in assisting with the technological needs of students. Please do not contact the instructor for this type of assistance. The Help Desk is much better equipped than I am to assist you!

Academic Dishonesty

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test (Chegg), or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one's own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) for possible disciplinary action. To learn more, please visit HOOP: Student Conduct and Discipline.

Reasonable Accommodation Policy:

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the UTEP Center for Accommodations and Support Services (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, or email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

Allowed Calculators

The following will be the only calculators allowed in exams:

- Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name.
- Hewlett Packard: The HP 33s and HP 35s models, but no others.
- Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

Excused Absences and/or Course Drop Policy

According to UTEP Catalog, "At the discretion of the instructor, a student can be dropped from a course because of excessive absences or lack of effort. A grade of "W" will be assigned before the course drop deadline and a grade of "F" after the course drop deadline." See Policies and Regulations in the UTEP Undergraduate Catalog for a list of excused absences. Therefore, if the student is at risk of failing due to non-performance in the course, the student may be dropped from the course. A 24-hour advance notice via email will be provided for such events.

Or,

The student can also contact the instructor and then the Registrar's Office to initiate the drop process. If the student does not do so, the student will be at risk of receiving an "F" for the course.

Makeup Work

Makeup work will be given *only* in case of a ***documented*** emergency. Note that makeup work may be in a different format than the original work and may require more intensive preparation. If the student misses an assignment and the reason is not considered excusable, will receive a zero. It is, therefore, important to reach out to the instructor in advance if at all possible and explain with proper documentation why you missed a given course requirement. Once a deadline has been established for makeup work, no further extensions or exceptions will be granted.

ALTERNATIVE MEANS OF SUBMITTING WORK IN CASE OF TECHNICAL ISSUES

I strongly suggest that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer. I also suggest you save all your work (answers to discussion points, quizzes, exams, and essays) in a separate Word document as a backup. This way, you will have evidence that you completed the work and will not lose credit. If you are experiencing difficulties submitting your work through the course website, please contact the UTEP Help Desk. You can email me your backup document as a last resort.

Incomplete Grade Policy

Incomplete grades may be requested only in exceptional circumstances after a student has completed at least half of the course requirements. Talk to the instructor immediately if an incomplete is warranted. If granted, the instructor will establish a contract of work to be completed with deadlines.

COURSE RESOURCES: Where you can go for assistance

UTEP provides a variety of student services and support. Please refer to the Q.R. code below for a listing of campus resources or visit https://www.utep.edu/advising/student_resources/student-success-resource-hub.html.

ACES & Tutoring Center from the College of Engineering

Please note there are tutoring services available in the ACES center.
https://www.utep.edu/engineering/student-resources/student-resources-aces-tutoring.html